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The Effect of Low-Power Laser Therapy on the TGF/β Signaling Pathway in Chronic Kidney Disease: A Review

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Abstract

Objective: The purpose of this study is to investigate the effects of low-power lasers on kidney disease by investigating several studies.

Methods: A number of articles from 1998 to 2019 were chosen from the sources of PubMed, Scopus, and only the articles studying the effect of low-power lasers on kidney disease were investigated.

Results: After reviewing the literature, 21 articles examining only the effects of low-power lasers on kidney disease were found. The results of these studies showed that the parameter of the low-power laser would result in different outcomes. So, a low-power laser with various parameters can be effective in the treatment of kidney diseases such as acute kidney disease, diabetes, glomerulonephritis, nephrectomy, metabolic syndrome, and kidney fibrosis. Most studies have shown that low-power lasers can affect TGFβ1 signaling which is the most important signaling in the treatment of renal fibrosis.

Conclusion: Lasers can be effective in reducing or enhancing inflammatory responses, reducing fibrosis factors, and decreasing reactive oxygen species (ROS) levels in kidney disease and glomerular cell proliferation.

Keywords: Low-power laser therapy; Chronic kidney disease; TGFβ1 signaling.

Introduction

The kidney is an organ with high blood flow. It has a functional unit called the nephron which consists of structural and functional parts, including glomeruli and tubules.[1] Chronic kidney disease (CKD) is a progressive disease in which the function of the kidney is impaired, leading to an increase in urea and creatinine levels within the blood, an increase in blood pressure, acidosis, hyperkalemia, a decrease in the calcium level and kidney filtration, and also kidney fibrosis.[2-4] The progression of the disease can lead to interstitial nephritis, glomeruli, and fibrosis.[5] The prevalence of the disease in the world is 10%. If it is left untreated, it can lead to end-stage renal disease which would be costly due to possible further kidney transplantation or dialysis.[6] In more than 100 countries worldwide, people are not able to receive long-term medical treatment. Thus, we will see annually more than one million deaths worldwide due to the untreated disease.[7] By 1990, kidney disease was ranked 27th in the list of causes of the total number of deaths worldwide, reaching 18th by 2010.[7] In fact, 25% of people whose ages range from 65 to 74 and who are diagnosed with CKD are men and 20% of them are also women. CKD result from other diseases such as diabetes, obesity, atherosclerosis, and high blood pressure.[8] Fibrosis is also attributed to the overgrowth and scar of various tissues as well as to the presence of extracellular elements including collagen, mainly due to mesenchymal cells residing in the tissue. In fact, fibrosis is the result of chronic inflammatory reactions. The etiology of fibrosis is not completely clear. Studies have shown that kidney fibrosis occurs in four stages. During the first stage, kidney tissue could be damaged due to diabetes, inflammation, and such diseases as glomerulonephritis and sclerosis. Diabetes

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